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In the Supreme Court of the United States

OCTOBER TERM, 1979

SIDNEY A. DIAMOND, COMMISSIONER OF PATENTS AND TRADEMARKS, PETITIONER

v.

TOMAS HIRSCHFELD, MARVIN MARGOSHES AND BLOCK ENGINEERING, INC.

PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE DISTRICT OF COLUMBIA CIRCUIT

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The Solicitor General, on behalf of the Commissioner of Patents and Trademarks, petitions for a writ of certiorari to review the judgment of the United States Court of Appeals for the District of Columbia Circuit in this case.

QUESTION PRESENTED

Whether a computer program that improves the readout from a television camera tube is patentable subject matter under 35 U.S.C. 101.

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OPINIONS BELOW

The opinion of the court of appeals (App. A, *infra*, 1a-2a) is not reported. The opinion and judgment of the district court (App. B, *infra*, 3a-17a) are reported at 462 F. Supp. 135. The opinion of the Patent and Trademark Office Board of Appeals (App. C, *infra*, 18a-24a) and the opinions of the patent examiner (App. D, *infra*, 25a-33a) are not reported.

JURISDICTION

The judgment of the court of appeals was entered on February 4, 1980 (App. A, *infra*, 2a). On May 8, 1980, the Chief Justice extended the time to file a petition for a writ of certiorari to and including July 3, 1980. The jurisdiction of this Court is invoked under 28 U.S.C. 1254. *Hoover Co.* v. *Coe*, 325 U.S. 79 (1945).

STATUTE INVOLVED

35 U.S.C. 101 provides:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

STATEMENT

On February 22, 1971, Tomas Hirschfeld and Marvin Margoshes applied for a patent on a computerized system for television camera tube readout.[1] Respondents' invention involves a computerized apparatus for reading the

[1] Hirschfeld and Margoshes have assigned the invention to Block Engineering, Inc. (App. B, *infra*, 3a).

image picked up by a television camera tube over time (App. E, *infra*, 34a). In a relatively new type of camera tube called an "SEC vidicon", electrons from the photocathode[2] are highly accelerated and focused onto a nonconducting "target" made of fibrous potassium chloride (*id.* at 35a–36a). A positive charge is trapped in the potassium chloride lattice and will remain stable there for several hours, during which time it may be transmitted to a receiver, or "read out" (*id.* at 36a). Readout of the SEC vidicon usually is obtained by scanning the potassium chloride target with an electron beam. Typically, a person wishing to examine one point on the target follows the scan path from the beginning until he reaches the particular point of interest on the target (App. E, *infra*, 36a). This causes delay in obtaining needed information *(ibid.)*. Respondents' claimed invention minimizes this delay by using a digital computer to control the readout without resort to a full scan (*id.* at 36a–37a).[3]

Respondents' system also improves readout image. The electron beam is directed by the computer to read selected, highly illuminated target areas while not immediately reading low illumination areas (*id.* at 37a–38a). The result is a more detailed readout image, relatively unobscured by the "noise" that otherwise is a problem at low

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[2] This is the part of the camera that initially receives the image seen by the camera and converts it into an electron image. *Encyclopedia of Science and Technology* 479 (McGraw-Hill 1971 ed.).

[3] The scanning electron beam produces an electric current pulse at its point of impact on the target. The pulse is an output signal, whose strength depends upon the intensity of the image at the selected point on the target. Each point on the target can be identified by reference to its vertical and horizontal coordinates. Respondents' claimed invention uses a computer program to identify the coordinates and the intensity of each output signal, and permits the user to read any particular target point directly without requiring a full scan (App. E, *infra*, 37a).

illumination levels (*id.* at 38a). The tube can thus be used to integrate signals for long periods, just as a conventional camera and film can be used for making time exposures.

The patent examiner rejected the invention for insufficient disclosure under 35 U.S.C. 112 (App. D, *infra*, 25a, 29a–30a). He found that although respondents could not be required to reveal the "particular details" of the "'logic circuit'" in the specification, they were not entitled to a patent because they had failed to set forth any specific mode for implementing what they claimed (*id.* at 25a, 29a). The Patent and Trademark Office Board of Appeals affirmed the rejection (App. C, *infra*, 21a–24a). The Board observed that respondents had not disclosed in "full, clear and exact terms" how the components described by respondents "may be selected, interconnected, timed, programmed and controlled so as to obtain the system operations claimed" (*id.* at 22a).[4]

Pursuant to 35 U.S.C. 145[5], respondents sued the Commissioner of Patents and Trademarks in district court to require him to issue a patent on the claims (App. B, *infra*, 3a). The Commissioner responded that the specification did not contain an adequate written description under 35 U.S.C. 112. And, after this Court's decision in *Parker* v. *Flook*, 437 U.S. 584 (1978), he also contended that the claims were unpatentable because their only novel element was a computer program for solving mathematical algorithms (App. B, *infra*, 12a).[6]

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[4]Neither the patent examiner nor the Board considered or decided whether the claims contained patentable subject matter under 35 U.S.C. 101.

[5]See, *e.g.*, *Hoover Co.* v. *Coe*, 325 U.S. 79 (1945).

[6]The district court allowed the Commissioner to amend his answer to raise this defense (App. B, *infra*, 12a).

The district court did not disagree with the Commissioner's contention that everything in the claims was old except for the computer program. Nonetheless, it held that because there was no procedure in the claims for solving a given type of mathematical problem, they did not recite an algorithm of the kind involved in *Parker* v. *Flook*, *supra* (App. B, *infra*, 12a, 15a). Relying on *Application of Freeman*, 573 F. 2d 1237 (C.C.P.A. 1978), the district court concluded that the claims contained patentable subject matter and that the patent should issue (*id.* at 15a–16a).[7]

The court of appeals summarily affirmed the district court "for the reasons stated in the opinion of Chief Judge Markey, sitting in the District Court" (App. A, *infra*, 2a).

REASONS FOR GRANTING THE PETITION

This case, like *Diamond* v. *Bradley*, cert. granted, No. 79–855 (Mar. 17, 1980); *Diamond* v. *Diehr*, cert. granted, No. 79–1112 (Mar. 17, 1980); and *Diamond* v. *Sherwood*, petition for cert., No. 79–1941, (filed June 9, 1980), presents the important issue of the patentability of computer programs. Those cases reflect the refusal of the Court of Customs and Patent Appeals to follow this Court's analysis in *Parker* v. *Flook*, 437 U.S. 584 (1978). This case, which was decided by Chief Judge Markey of the Court of Customs and Patent Appeals (sitting by designation), and affirmed by the court of appeals on Judge Markey's opinion, is another example of the same refusal.[8]

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[7] The district court also found that the specification contained an adequate disclosure under Section 112 (App. B, *infra*, 14a–15a) and the court of appeals affirmed (App. A, *infra*, 2a). We do not ask this Court to review that conclusion. Accordingly, the only issue remaining in the case is whether the claims recite statutory subject matter under Section 101.

[8] This case was brought under 35 U.S.C. 145 as a civil action in the

Analysis of the instant application as required by *Parker* v. *Flook*, 437 U.S. 584 (1978), shows that the only novelty in the claims resides in a computer-implemented algorithm. Respondents conceded that the machinery described in the claims, such as an "electro-optical imaging device" and a "digital storage and control system," was previously known (R. 139; App. C, *infra*, 20a).[9] They stipulated that the concept of allowing the image to integrate on the face of the tube (see page 3, *supra*) was "well known" (R. 139).[10] Thus, the only arguably novel aspects of respondents' claims are the functions described in the limitations in their claims[11] that respondents' expert ac-

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district court challenging the Commissioner's refusal to issue a patent. In such cases, the district court is not confined to a review of the record upon which the Board of Appeals acted, but may consider new evidence and decide the case "upon the whole merits." *American Steel and Wire Co. of New Jersey* v. *Coe*, 105 F. 2d 17, 19 (C.A.D.C. 1939) (quoting *Butterworth* v. *United States*, 112 U.S. 50 (1884)); *California Research Corp.* v. *Ladd*, 356 F. 2d 813, 821 (C.A.D.C. 1966). Accordingly, the district court properly permitted respondents to adduce expert testimony concerning the effectiveness of their disclosure, and similarly permitted the Commissioner to assert an additional defense after the decision in *Parker* v. *Flook*, *supra*, made it clear that the instant application involved nonstatutory subject matter.

[9] "R." refers to the record on appeal in the court of appeals.

[10] See U.S. Patent No. 2,700,066 to Vorms, patented January 18, 1955, filed October 19, 1949 (R. 343-344).

[11] These were as follows (App. B, *infra*, 4a-5a):

> 15. In combination with an electro-optical imaging device * * *, a digital control system comprising: * * * means for activating said means for generating said beam at the repetition rate for each of said target points in relation to the intensity of the radiation falling on each of said target points for a unit time interval.
>
> 12. The combination as defined in Claim 15 wherein said repetition rate is substantially inversely related to the said intensity.
>
> 13 The combination as defined in Claim 15 including means for establishing a plurality of categories of pairs of digital signals according to the relative intensity during said time interval of the image points corresponding to said pairs of digital signals.

knowledged were performed by a computer program (R. 151-154; see R. 100-102; App. B, *infra*, 12a).[12]

Since everything in respondents' claims is old save for a computer-implemented algorithm, the case is not meaningfully distinguishable from *Application of Bradley*, 600 F. 2d 807 (C.C.P.A. 1979), cert. granted, No. 79-855 (Mar. 17, 1980). In each case the applicants' specification describes well-known machinery whose only novelty resides in an algorithm for a computer program. In each case the court below, relying on Court of Customs and Patent Appeals precedent, considered it dispositive that the algorithm was not "mathematical," i.e., it did not manipulate data to arrive at a solution to a numerical problem (App. B, *infra*, 15a).

We have explained in our brief in *Bradley* why the Court of Customs and Patent Appeals' distinction between "mathematical" and "nonmathematical" algorithms is unsound, and why a novel computer-implemented algorithm, when claimed together with machinery that is old in form and arrangement, is unpatentable under *Parker* v. *Flook* [13] That reasoning is equally applicable here. If, as we submit, *Bradley* was wrongly decided, this case similarly requires reversal.

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[12] The program described by respondents' computer expert utilized logarithms to compute the frequencies at which each point should be read (R. 103-105).

[13] We are sending respondents a copy of our brief in *Bradley*.

CONCLUSION

The petition should be held pending the Court's decision in *Diamond* v. *Bradley*, *supra*, and then disposed of as appropriate in light of that decision.

Respectfully submitted.

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JULY 1980

APPENDIX A

United States Court of Appeals

FOR THE DISTRICT OF COLUMBIA CIRCUIT

SEPTEMBER TERM, 1979

CIVIL ACTION NO. 75-1147

No. 79-1223

TOMAS HIRSCHFELD, ET AL.

v.

DONALD W. BANNER, COMMISSIONER OF PATENTS AND TRADEMARKS, APPELLANT

APPEAL FROM THE UNITED STATES DISTRICT COURT FOR THE DISTRICT OF COLUMBIA

BEFORE: ROBB, WILKEY AND WALD,
Circuit Judges

JUDGMENT

THIS CAUSE came on to be heard on the record on appeal from the United States District Court for the District of Columbia, and was argued by counsel. While the issues presented occasion no need for an opinion, they have been accorded full consideration by the Court. *See* Local Rule 13(c).

ON CONSIDERATION OF THE FOREGOING. It is ordered and adjudged by this Court that the judgment of the District Court appealed from in this cause is hereby affirmed, for the reasons stated in the opinion of Chief Judge Markey, sitting in the District Court.

Per Curiam

FOR THE COURT:

/s/ _____

GEORGE A. FISHER
Clerk

FILED: Feb. 4, 1980

APPENDIX B

UNITED STATES DISTRICT COURT FOR THE DISTRICT OF COLUMBIA

CIVIL ACTION NO. 75–1147

TOMAS HIRSCHFELD, MARVIN MARGOSHES, AND BLOCK ENGINEERING, INC., PLAINTIFFS

v.

DONALD W. BANNER, COMMISSIONER OF PATENTS AND TRADEMARKS, DEFENDANT

FINDINGS OF FACT

1. Plaintiffs Thomas Hirschfeld, Marvin Margoshes, and Block Engineering, Inc. brought this action under 35 USC 145, seeking to have this court authorize defendant Donald W. Banner, Commissioner of Patents and Trademarks, to issue a patent containing claims 12, 13, and 15, the only claims at issue in plaintiffs' application entitled "Digitally Controlled Electro-Optical Imaging System," serial No. 117,285, filed February 22, 1971. The inventors are Tomas Hirschfeld and Marvin Margoshes. The application is assigned to Block Engineering, Inc.

2. The invention is directed to a digitally controlled television camera tube, such as a secondary electron conduction (SEC) vidicon. Individual points of an image formed on the target element of the tube are read by generating and positioning the electron beam. An output signal, produced in correspondence with the intensity of the radiation at the point being read, is digitized and

stored in a computer. The electron beam is directed to a specific point on the target by computer-provided digital address signals converted into control voltages to position the beam. Because of the rapid point-by-point readout of the target, some points in weakly illuminated areas of the image do not accumulate sufficient stored charge to be read as frequently as points in the highly illuminated areas. Plaintiffs' system increases the dynamic range of the vidicon by generating the electron beam at a repetition rate for each point in relation to the intensity of radiation falling on that point. Points exposed to low intensity radiation are thus read only when the illumination signal has been sufficiently integrated to yield an acceptable signal-to-noise ratio.

3. The claims at issue are:

15. In combination with an electro-optical imaging device having target means for receiving an image and means for generating an electron-beam for reading the image formed on said target means in said device, said target being capable of integrating the radiation falling on each point thereof, means for controlling the lateral deflection of said electron beam, and means for providing output signals corresponding to the intensity of the image as read by said electron-beam means, a digital control system comprising:

means for storing a plurality of pairs of digital signals, each corresponding to a pair of coordinates of a corresponding predetermined point on said target;

means for converting selected pairs of said digital signals to corresponding pairs of analog-valued control signals;

means for applying said control signals to said means for controlling said lateral deflection, and;

means for activating said means for generating said beam at the repetition rate for each of said target points in relation to the intensity of the radiation falling on each of said target points for a unit time interval.

12. The combination as defined in Claim 15 wherein said repetition rate is substantially inversely related to the said intensity.

13. The combination as defined in Claim 15 including means for establishing a plurality of categories of pairs of digital signals according to the relative intensity during said time interval of the image points corresponding to said pairs of digital signals.

4. Plaintiffs and defendant filed a stipulation, this court consenting, to the issue as arising under 35 USC 112:

> [T]he sole issue arising out of the Examiner's Answer and the decision of the Board of Appeals . . . is whether or not the specification . . . contains a written description of the invention claimed in claims 15, 12 and 13 in [the] application, and of the manner and process of making and using such invention sufficient to enable any person skilled in the art to which said invention pertains, or with which said invention is most clearly connected, to make and use the same.

5. The stipulated 35 USC 112 issue concerns, *inter alia*, the following drawings disclosed in the specification:

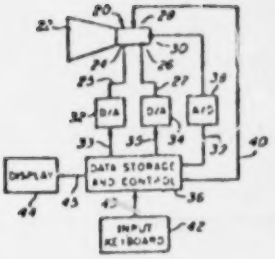

FIG. 1.

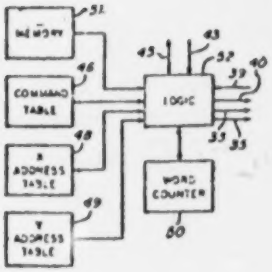

FIG. 2.

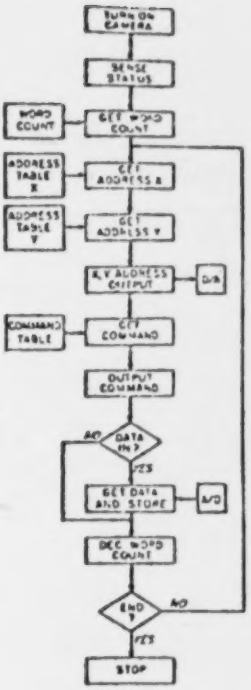

FIG. 3.

The figures are schematic block diagrams, in which Figure 1 represents a digitally controlled camera system, Figure 2 depicts in general the organization of the data, storage and control means 36, and Figure 3 represents an operational flow diagram of the system of Figure 1. The specification states at page 9, line 1–13 that:

> [T]he organization of storage and control means 36 is typical of a simple computer system and includes necessarily a command memory or table 46 in which various orders or commands can be stored under appropriate addresses, an address table 48 for containing all of one set of coordinates such as X coordinates, and another address table 49 for storing all the other set of coordinates, such as the Y coordinates. Additionally, storage and control means includes a word counter 50, a storage or memory means 51 and a logic section 52 organized to carry out the function shown in the sample program flow chart of Figure 3. All of

> the foregoing elements being quite conventional in the art, require no further description here.

The specification also discloses that the operational flow diagram of Figure 3 can be accomplished with data storage and control means 36 as an appropriately programmed general purpose digital computer.

6. In describing the operation of the system to generate the electron beam at a repetition rate for each image point in relation to the radiation intensity at each such point, the specification states at page 12, line 18 through page 13, line 14 that:

> [A]ddresses can be provided for storage in tables 48 and 49 respectively by entry through keyboard 42. However, it will be apparent that the requisite data can also be obtained by interrogations or examinations of the target area to determine what image points should be read according to some predetermined parameter. For example, the system can be instructed to complete a full raster scan and generate the coordinates of all image points or resolution elements that provide a signal below a first selected amplitude. These signals, whether self-generated or fed in through the keyboard, are recorded in memory 51, for example, in a first "low" intensity register. All points providing a signal above the first but below a second selected amplitude are recorded in memory 51 in a second "low" intensity register, and so forth until all image points have their respective coordinates stored accordingly as they are classified as to brightness. If now the image is restored to the target of the vidicon, for example, one can provide appropriate logic which will command the selective read-out of the image points according to their brightness. Thus, the strongest intensity points are read out at the highest repetition rate and the weaker points are read out less frequently.

7. The final rejection under 112 for lack of enablement was principally directed to the logic section 52. The examiner contended that the selection or design of the logic section was neither clearly within the established ordinary skill of the art, nor determinable with little or no experimentation.

8. In agreeing with the examiner's conclusions, the Patent and Trademark Office Board of Appeals (board) gave the following additional analysis:

> At the outset we note that no specific computer is cited in the disclosure as an exemplary such element for implementing data storage and control element 36 or the various blocks shown in Figure 2, for example. Additionally, we note that no general purpose computer will perform as appellants wish, unless it is properly programmed. We further note that the flow chart shown in Figure 3 would appear to be directed toward implementation of operations . . . wherein information stored at various addressable locations of the target may be read and stored in memory 51, or erased from the target area. We find no program or even a flow chart for implementing the operation claimed and described . . . [in] the specification, wherein all the image points of the target are classified as to brightness, and the coordinates of the classified image points are stored in memory 51 in a particular manner. In our view, even if a routineer in the art selected an exemplary general purposes computer to implement element 36, further selected other exemplary elements to implement the other blocks shown in Figure 1, and still further programmed the computer so as to implement the flow chart shown in Figure 3, the results obtained would not appear to be that which is set forth in the claims at bar.
>
> . . . In our view, the instant disclosure fails to disclose in full, clear and exact terms how such elements, if they exist, may be selected, interconnected, timed, programmed and controlled so as to obtain the system

> operations claimed. As such, we view appellants' disclosure as little more than an invitation to those skilled in the art to experiment extensively so as to reduce the system to practice. Compliance with requirements of the first paragraph of 35 USC 112 is not obtained merely because one of ordinary skill in the art might after extensive experimentation along the line indicated in the disclosure, find out how to make and use the invention claimed. The disclosure itself must furnish such information.

9. The art to which the claimed invention pertains is the computer control of optical systems.

10. Witness David S. Grey is skilled in the art of computer-controlled optical systems.

11. In June of 1975 plaintiffs' attorney presented Grey with a copy of the specification, drawings, and claims of plaintiffs' application and asked him whether the disclosure contained adequate teaching to enable one skilled in the art to make and use the invention as claimed. No other information was given to Grey. Prior to his receipt of the application, Grey did not know of its existence.

12. Grey, using computer programming techniques known by those skilled in the art prior to February 1971, wrote a general computer program for implementation of the embodiment of Figures 1–3 within four hours after receipt of the application. The program contained certain routine programming errors of the type customarily expected and eliminated during a routine "debugging" operation. Such errors would quickly and easily be eliminated by one skilled in the art. Grey's program was not written for any specific computer and therefore contained some general portions written in English rather than the Fortran IV computer language used elsewhere throughout the program. The details for completing the program for a

specific computer installation would require no undue experimentation on the part of one skilled in the art.

13. Prior to February 1971, a number of general purpose digital computers which would accept Fortran IV computer language were commercially available. Typical of such computers were IBM 360, IBM 7090, IBM 7094, and CDC 6000 series.

14. When completely debugged of routine programming errors and adapted for use with a specific computer installation comprising one of the general purpose computers available as of February 1971, the program written by Grey would implement the functions described in the specification at page 2, line 3–8, 19–22, page 6, line 5–14; page 2, line 1–9; and page 12, line 20 through page 13, line 15.

15. The witness, Robert B. Turner, was by stipulation an expert in electrical engineering and computer programming.

16. Turner became generally familiar with the subject matter of plaintiffs' invention about the winter of 1973–74. Turner was not involved in the original design or development of the invention, known as the TVS project, but did understand that the project involved increasing the dynamic range of a television camera tube by reading and accumulating the value of image points according to intensity, the lower intensity image points being read least frequently to allow the tube to integrate these points.

17. When presented with a copy of Grey's program, Turner recognized it as a program for the TVS system after less than ten minutes of study and stated that it appeared to provide for scanning the X–Y coordinates of an imaging tube and for reading and storing values of selected image points in proportion to the rate at which each image point accumulated data.

18. Plaintiffs' independent claim 15 is written in *Jepson* form, viz., portions relating to the prior art appear in the preamble. The limitations recited in the preamble are specifically described in the specification at page 2, line 19 through page 4, line 3.

19. The claim 15 limitation, "means for storing a plurality of pairs of digital signals, each corresponding to a pair of coordinates of a corresponding predetermined point on said target," is depicted as memory 51 in Figure 2 and described in the specification text at page 9, line 1 through page 10, line 18.

20. The claim 15 limitation, "means for converting selected pairs of said digital signals to corresponding pairs of analog-valued control signals," is depicted as the digital-to-analog converters 32 and 34 of Figure 1 and described in the specification text at page 10, line 2–7.

21. The claim 15 limitation, "means for applying said control signals to said means for controlling said lateral deflection," is depicted as lines 25 and 27 in Figure 1 and described at page 7, line 17 through page 8, line 14.

22. The claim 15 limitation, "means for activating said means for generating said beam at a repetition rate for each of said target points in relation to the intensity of the radiation falling on each of said target points for a unit time interval," is specifically described at page 12, line 18 through page 13, line 15.

23. The claim 12 limitation, "wherein said repetition rate is substantially inversely related to the said intensity," is described at page 13, line 12–15.

24. The claim 13 limitation, "means for establishing a plurality of categories of pairs of digital signals according to the relative intensity during said time interval of the image points corresponding to said pairs of digital sig-

nals," is described at page 13, line 16 through page 14, line 2.

25. The claim limitations quoted in findings of fact 22–24 describe functions carried out by the disputed logic section 52, which together with memory 51, command table 46, address tables 48 and 49, and word counter 50, comprises data storage and control means 36, a conventional general purpose digital computer programmed in the manner described by Grey.

26. Defendant presented no witnesses. Its limited cross-examination of witnesses Grey and Turner produced no change and reflected no weakness in their testimony.

27. The new evidence introduced by plaintiffs at trial thoroughly convinces the court that error occurred in the rejection of claims 15, 12, and 13 for insufficient disclosure under 35 USC 112, first paragraph.

28. The court granted defendant's MOTION FOR LEAVE TO AMEND ANSWER filed September 26, 1978, the eve of trial, and denied plaintiffs' related MOTION TO LIMIT ISSUES AT TRIAL. In the amended answer defendant asserts as an additional defense the unpatentability of claims 15, 12, and 13 under 35 USC 101 "as being directed to a mathematical algorithm at the point of novelty," citing *Parker* v. *Flook*, 437 U.S. ___, 198 USPQ 193 (1978).

29. Claims 15, 12, and 13 recite no mathematical equation, formula, or method of calculation, either in traditional mathematical symbols or as a prose equivalent thereof.

CONCLUSIONS OF LAW

1. In a 35 USC 145 action, the Patent and Trademark Office (PTO) decision that claims are not patentable, for lack of sufficient disclosure under the first paragraph of 35

USC 112 is entitled to great weight, amounting to a presumption of correctness. Nonetheless, this court must conclude that the applicants are entitled to a patent where new evidence has been introduced which "thoroughly convinces" the court that error has occurred. *Cf. Corning Glass Works* v. *Brenner*, 152 U.S. App. D.C. 262, 263–64, 470 F.2d 410, 411–12, 175 USPQ 516, 517 (1972); *DeSeversky* v. *Brenner*, 137 U.S. App. D.C. 369, 370, 424 F.2d 857, 858, 164 USPQ 495, 496 (1970); *California Research Corp.* v. *Ladd*, 123 U.S. App. D.C. 60, 65, 356 F.2d 813, 818, 148 USPQ 404, 408 (1966); *Tietig* v. *Ladd*, 228 F. Supp. 637, 639, 141 USPQ 372, 374 (D.D.C. 1964) ("clearly erroneous or lacks a rational basis").

2. In an action under 35 USC 145 the record produced before the PTO forms the evidentiary nucleus before the district court, but additional evidence is admissible to support contentions advanced by the plaintiff in the PTO. *Monsanto Co.* v. *Kamp*, 269 F. Supp. 818, 822, 154 USPQ 259, 260 (D.D.C. 1967); *see DeSeversky* v. *Brenner*, *supra*. Defendant does not challenge the admissibility of plaintiffs' evidence in this case, except to note that evidence of enablement, which is not limited to supporting points made before the PTO, is inadmissible. The evidence offered by plaintiffs was so limited.

3. "Employment of block diagrams and descriptions of their functions is not fatal under 35 USC 112, first paragraph, providing the represented structure is conventional and can be determined without undue experimentation. *In re Ghiron*, 58 CCPA 1207, 442 F.2d 985, 169 USPQ 723 (1971)." *In re Donohue*, 550 F.2d 1269, 1271, 193 USPQ 136, 137–38 (CCPA 1977). *See In re Gunn*, 537 F.2d 1123, 1127–28, 190 USPQ 402, 405 (CCPA 1976).

4. It is not opinion evidence directed to the ultimate legal question of enablement, but rather factual evidence

directed to the amount of time and effort and level of knowledge required for practice of the invention from the disclosure alone, which can be expected to rebut a prima facie case of nonenablement. *In re Brandstadter*, 484 F.2d 1395, 1405–07, 179 USPQ 286, 293–95 (CCPA 1973); *In re Brown*, 477 F.2d 946, 951–52, 177 USPQ 691, 694–95 (CCPA 1973); *see In re Naquin*, 55 CCPA 1428, 1431, 398 F.2d 863, 866, 158 USPQ 317, 319 (1968); *cf. In re Gunn*, *Supra*. Unlike the circumstances in *Brandstadter* and *Brown*, wherein nonenablement was sustained by the court, the witnesses here testified to facts establishing enablement. Hence this case is more akin to *Naquin* with respect to evidence offered to rebut a rejection under 35 USC 112, first paragraph.

5. The first paragraph of 35 USC 112 requires that the specification be complete enough to enable one of ordinary skill in the art to make and use the invention without undue experimentation. The prohibition of "undue" experimentation means that the need for a minimum amount of experimentation is not fatal. Every detail need not appear in the specification, if the skill of the art is such that what does appear enables one skilled in the art to make and use the invention. *In re Gaubert*, 524 F.2d 1222, 1226, 187 USPQ 664, 667 (CCPA 1975); *Martin* v. *Johnson*, 59 CCPA 769, 775, 454 F.2d 746, 751, 172 USPQ 391, 395 (1972). The specification need not describe the conventional nor disclose what the skilled already possess. *General Electric Co.* v. *Brenner*, 132 U.S. App. D.C. 323, 326, 407 F.2d 1258, 1261, 159 USPQ 335, 337 (1968).

6. Plaintiffs' specification describes the invitation of claims 15, 12, and 13 in sufficient detail that one skilled in the computer control of optical systems could have made and used the invention as of the filing date by choosing then-existing computer and concomitant interface equip-

ment and interconnecting and programming such equipment without undue experimentation.

7. Plaintiffs' specification satisfies the enablement requirement of the first paragraph of 35 USC 112 with respect to claims 15, 12, and 13.

8. The PTO erred in rejecting claims 15, 12, and 13 for insufficient disclosure under 35 USC 112, first paragraph.

9. Claims 15, 12, and 13 neither recite nor contain an "algorithm" within the meaning of that term in *Parker* v. *Flook*, *supra* and *Gottschalk* v. *Benson*, 409 U.S. 63, 175 USPQ 673 (1972). "We use the word 'algorithm' in this case, as we did in *Gottschalk* v. *Benson*, 409 U.S. 63, 65 to mean '[a] procedure for solving a given type of mathematical problem. . . .'" *Parker* v. *Flook*, *supra*, at ___ n.1, 198 USPQ at 195 n.1.

10. A claim does not fail to state statutory subject matter merely because it requires a computer program for implementation. *In re Freeman*, 573 F.2d 1237, 1245, 197 USPQ 464, 470 (CCPA 1978).

11. A claim cannot be directed to a mathematical algorithm when the claim itself fails either directly or indirectly, to recite a mathematical algorithm. *See In re Freeman*, *supra*, at 1245, 197 USPQ at 471.

12. The invention of claims 15, 12, and 13 constitutes statutory subject matter under 35 USC 101, whether the claims be viewed as drawn to apparatus or to a process expressed as means for performing the steps of that process.

13. On the present record, plaintiffs are entitled to a patent on the invention described in application serial No. 117, 285 and claimed in claims 15, 12, and 13.

14. The defendant should be authorized to issue such a patent upon compliance with the requirements of law.

Date: 20 November 78 /s/ _____

HOWARD T. MARKEY*
Chief Judge

---

*Chief Judge, United States Court of Customs and Patent Appeals, sitting by designation.

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA

CIVIL ACTION NO. 75-1147

TOMAS HIRSCHFELD, MARVIN MARGOSHES, AND BLOCK ENGINEERING, INC., PLAINTIFFS

v.

DONALD W. BANNER, COMMISSIONER OF PATENTS AND TRADEMARKS, DEFENDANT

JUDGMENT

In accordance with the Findings of Fact and Conclusions of Law entered of even date herewith, it is, by the Court, this 20th day of November, 1978,

ORDERED AND ADJUDGED that plaintiffs' request for relief be, and the same hereby is, granted and that judgment in the action be, and the same hereby is, entered for the plaintiffs.

ORDERED that defendant is authorized to issue a patent on the invention described in application serial No. 117,285 and claimed in claims 15, 12, and 13 upon plaintiffs' compliance with the requirements of law.

/s/ _____
HOWARD T. MARKEY
Chief Judge

---

*Chief Judge, United States Court of Customs and Patent Appeals, sitting by designation.

APPENDIX C

Group No. 233

Paper No. 21

Appeal No. 184-58

Hearing: April 16, 1975

UNITED STATES PATENT AND TRADE MARK OFFICE

BEFORE THE BOARD OF APPEALS

Ex parte Tomas Hirschfeld
and
Marvin Margoshes

Application for Patent Filed Feb. 22, 1971, Serial No. 117,285. Digitally Controlled Electro-Optical Imaging System.

Schiller and Pandiscio for appellants.

Before Bennett and Henon, Examiners-in-Chief, and Craig, Acting Examiner-in-Chief.

Henon, Examiner-in-Chief.

This is an appeal from the decision of the examiner rejecting claims 12, 13 and 15, which are all the claims remaining in the application.

The invention relates to a combination of an electro-optical imaging device with a digital control system wherein the beam for reading the points of an image formed on a target element of the imaging device is generated at a repetition rate for each such point in relation to the image intensity at each such image point.

Claim 15, the only independent claim at bar is as follows:

> 15. In combination with an electro-optical imaging device having target means for receiving an image and means for generating an electron-beam for reading the image formed on said target means in said device, said target being capable of integrating the radiation falling on each point thereof, means for controlling the lateral deflection of said electron beam, and means for providing output signals corresponding to the intensity of the image as read by said electron-beam means, a digital control system comprising:
>
> means for storing a plurality of pairs of digital signals, each corresponding to a pair of coordinates of a corresponding predetermined point on said target;
>
> means for converting selected pairs of said digital signals to corresponding pairs of analog-valued control signals;
>
> means for applying said control signals to said means for controlling said lateral deflection, and;
>
> means for activating said means for generating said beam at a repetition rate for each of said target points in relation to the intensity of the radiation falling on each of said target points for a unit time interval.

No references are relied on by the examiner.

Claims 12, 13 and 15 stand rejected under 35 USC 112, first paragraph, as based upon an insufficient disclosure. The rejection of the claims at bar under 35 USC 112, second paragraph, as functional and incomplete stands withdrawn.

The examiner urges that the instant disclosure fails to enable a person of ordinary skill in the art to make and use the invention claimed without undue experimentation. The examiner further urges that the instant disclosure fails to comply with the "best mode" requirement of the statute in that appellants have failed to set forth any specific mode for implementing that which is claimed. It is the position of the examiner that although no logic circuit is specifically recited as an element in the claims at bar, such a logic circuit is required for operability of that which is claimed. The examiner contends that no specific structure is disclosed for logic element 52, and that implementation of the plural functions desired from such logic would require more than routine experimentation. The examiner further contends that if element 36, which includes logic element 52, is in fact a general purpose computer, the flow chart illustrated in Figure 3 is insufficient to obtain the function recited in the last four lines of claim 15, and the functions recited in dependent claims 12 and 13.

Appellants urge that the "essence" of their invention is the combination of a known electro-optical imaging device and a known digital storage and control system, the combination of which achieves a new and unexpected result. Appellants contend that logic circuit 52 is not the essence of their invention and would appear to urge (Brief page 8, page 11) that the best mode contemplated of implementing the invention would include the use of any general purpose computer wherein the instruction format is of a two address nature, and which is capable of being programmed to

perform the desired functions such as those shown in Figure 3. As such, appellants contend (Brief, page 8) that no new computer organization or any particular circuit arrangement is necessary to carry out the teachings of the invention. Appellants conclude that the disclosure is directed to those of ordinary skill in the art, and that a routineer in the art could implement their disclosure without undue experimentation.

We have carefully reviewed the entire record before us, including the extensive arguments of both appellants and the examiner, and as a result of such review, we agree with the conclusions reached by the examiner for the reasons presented in his answer, as amplified by our comments below.

At the outset we note that no specific computer is cited in the disclosure as an exemplary such element for implementing data storage and control element 36 or the various blocks shown in Figure 2, for example. Additionally, we note that no general purpose computer will perform as appellants wish, unless it is properly programmed. We further note that the flow chart shown in Figure 3 would appear to be directed toward implementation of operations (pages 9–11 of the specification) wherein information stored at various addressable locations of the target may be read and stored in memory 51, or erased from the target area. We find no program or even a flow chart for implementing the operation claimed and described at pages 12 and 13 of the specification, wherein all the image points of the target are classified as to brightness, and the coordinates of the classified image points are stored in memory 51 in a particular manner. In our view, even if a routineer in the art selected an exemplary general purpose computer to implement element 36, further selected other exemplary elements to implement the other blocks shown

in Figure 1, and still further programmed the computer so as to implement the flow chart shown in Figure 3, the results obtained would not appear to be that which is set forth in the claims at bar.

Viewing the recitation of desired results found at pages 12–14 of the instant disclosure to which the claims at bar appear to be directed, we find insufficient teachings to enable a routineer in the art to make and use the invention claimed. Although many versions of the elements shown in Figure 1, for example, may be known in the prior art, not all such versions will work in combination so as to obtain appellants' desired results. Further, as aforementioned, no prior art computer will function as appellants desire unless properly programmed. In our view, the instant disclosure fails to disclose in full, clear and exact terms how such elements, if they exist, may be selected, interconnected, timed, programmed and controlled so as to obtain the system operations claimed. As such, we view appellants' disclosure as little more than an invitation to those skilled in the art to experiment extensively so as to reduce the system practice. Compliance with requirements of the first paragraph of 35 USC 112 is not obtained merely because one of ordinary skill in the art might after extensive experimentation along the line indicated in the disclosure, find out how to make and use the invention claimed. The disclosure itself must furnish such information. Note *In re* Scarbrough, 500 F.2d 560, 182 USPQ 298 (CCPA, 1974). Under these circumstances we find that the examiner had a reasonable basis for questioning the adequacy of the instant disclosure and requiring appellants to show that a routineer in the art could make and use the invention from the description given. Note *In re* Ghiron et al, 58 CCPA 1207, 442 F.2d 985, 169 USPQ 723 (1971); *In re* Brown, 477 F.2d 946, 177 USPQ 691 (CCPA, 1973); *In re* Doyle, 482 F.2d 1385, 179 USPQ 227 (CCPA, 1973); *In re*

Brandstadter et al, 484 F.2d 1395, 179 USPQ 286 (CCPA 1973) and *In re* Scarbrough, *supra*.

We are not persuaded by appellants' argument that merely disclosing labeled rectangles accompanied by a statement of function desired therefrom, and generally alleging that such elements are well known in the art or could be easily constructed, is sufficient to comply with the statute. Although the third paragraph of 35 USC 112 does not add further disclosure requirements to those found in the first paragraph of 35 USC 112, the third paragraph presumes that such elements have been described somewhere in the specification in full, clear and exact terms. Note *In re* Knowlton, 481 F.2d 1357, 178 USPQ 486, (CCPA, 1973). In our view, disclosing and claiming an element with the same degree as specificity e.g., as a means or element for performing a specified function, is not a full, clear and exact description. The foregoing is especially applicable where the element in question is a complex element which is to perform a plurality of functions.

We are also not persuaded by appellants' arguments that since logic circuits are well known, and the "essence" of appellants' invention is clear, disclosure of specific logic circuitry might overshadow or obscure the invention. Although we would agree that the concepts of appellants' invention insofar as desired results to be obtained are clear, we disagree that the invention claimed (the new combination of elements) is clear from the disclosure. Disclosure of the details of the elements in question, and the interconnection and control of such elements so as to obtain a combination of elements that would cooperate to obtain the desired results, would not in our view overshadow or obscure the "essence" of the claimed invention.

Accordingly, for the reasons presented by the examiner as amplified by our comments above, the decision of the examiner rejecting claims 12, 13 and 15 as based upon an insufficient disclosure under 35 USC 112, first paragraph, is affirmed.

AFFIRMED

/s/ _____
R. D. BENNETT
Examiner-in-Chief

/s/ _____
P. J. HENA
Examiner-in-Chief

/s/ _____
KERRY L. CRAIG
Examiner-in-Chief (Acting)

BOARD OF APPEALS

APPENDIX D

Patent Office

Address Only: COMMISSIONER OF PATENTS
Washington, D.C. 20231

Paper No. 6

[Stiller 233
02/22/71 117,285]
Tomas Hirschfeld, et al.

Dated: 1.4.73

Schiller & Pandiscio
Bear Hill Tower
60 Hickory Dr.
Waltham, Mass. 02154

This is a communication from the Examiner in charge of your application.

Commissioner of Patents

☐ This application has been examined.

☑ Responsive to communication filed SEPT. 14, 1972 ☐ This action is made final.

A SHORTENED STATUTORY PERIOD FOR RESPONSE TO THIS ACTION IS SET TO EXPIRE

3 MONTH(S) 0 DAYS FROM THE DATE OF THIS LETTER.

PART I

The following attachments) are part of this action

a. ☑ Notice of References Cited, Form PO-892. b. ☐ Notice of Informal Patent Drawing, PO-948

c. ☐ Notice of Informal Patent Application, Form PO-152 d. ☐

PART II

Summary of Action

1. ☑ Claims 1-14 are presented for examination.

2. ☐ Claims _____ are allowed.

3. ☐ Claims _____ would be allowable if amended as indicated.

4. ☑ Claims 1-14 are rejected.

5. ☐ Claims _____ are objected to.

6. ☐ Claims _____ are subject to restriction or election requirement.

7. ☐ Claims _____ are withdrawn from consideration.

8. ☐ Since this application appears to be in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under Ex parte Quayle, 1935 C.D. 11, 453 O.G. 213.

9. ☐ Since it appears that a discussion with applicant's representative may result in agreements whereby the application may be placed in condition for allowance, the examiner will telephone the representative within about 2 weeks from the date of this letter.

10. ☑ Receipt is acknowledged of papers under 35 USC 119, which papers have been placed of record in the file.

11. ☐ Applicant's claim for priority based on an application filed in _____ on _____ is acknowledged. It is noted, however, that a certified copy as required by 35 USC 119 has not been received.

12. ☐ Other

The submitted drawing corrections will be made only upon a finding of allowable subject matter.

In the specification, page 15, line 4, it is believed "of" should be deleted.

The drawings are objected to under rule 83(a) for not depicting features recited in claims 1 through 14.

Claims 11, 12 and 13 are objected to as being in improper claim sequence—see MPEP 608.01(n).

The specification is again objected to under 35 USC 112 paragraph 1, with respect to claims 11, 12 and 13. The question as to whether the "logic circuit" that could be employed to perform the desired functions would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains is not at issue—it is applicant's responsibility to provide a disclosure as required by law. While the Office will not require applicants to disclose the particular details of the "logic circuit", the Office will not allow claims to the subject matter concerned; applicant's contention that such a disclosure would obscure the invention is certainly in error.

Claims 11, 12 and 13 are again rejected under 35 USC 112 for insufficient disclosure for the reasons stated above.

Claims 1 through 14 are rejected under 35 USC 112. With respect to claim 1: "an image formed on an image surface in said device" is functional—a statement of a desired situation without statements of required structure; the claim is incomplete without first a "means for providing a plurality of pairs of digital signals, each corresponding to a pair of coordinates of a corresponding predetermined point on said image surface"; the claim is incomplete without apparatus to produce "selected pairs"; line 14 should read "means for applying at least one of said . . ." if the claim is to describe one dimensional deflection, otherwise "lateral" must be defined as two dimensional. Claim 6 is incomplete because it is not sufficiently related to the preceding structure. In claim 11, "and being capable of integrating the radiation falling on each point thereof" is

functional; the remainder of the claim is not clearly understood. Claim 12 is functional. Claim 13 is not clearly understood and appears to be incomplete.

Claims 1, 2, 4 and 14 are rejected under 35 USC 102 as anticipated by Nezu.

Claims 3 and 5 through 10 are rejected under 35 USC 103 as unpatentable over Nezu. The claimed subject matter is deemed obvious to one of ordinary skill in the art in view of Nezu and the working knowledge of the art carried by one of ordinary skill in the art for the following reasons treated briefly. With respect to claim 3, storage of digital signals is well known; storage is employed when one wishes to be able to reproduce information at a subsequent time. With respect to claim 5, all commercial cameras include "means for selectively activating" e.g. by way of a master ON-OFF switch or power jack. With respect to claim 6, "sequentially selecting" is the expected functioning of Nezu. With respect to claim 7, such structure is expected to be found in the computer of Nezu. With respect to claim 8, the computer of Nezu is expected to have a memory; it would be obvious to employ some for output signals because it is at hand. With respect to claims 9 and 10 see Nezu at column 4 lines 36–38.

Stone and Froschle are made of record for their teachings of digitally controlled scanning of cameras by computers.

/s/ _____

ROBERT L. GRIFFIN
Examiner, Group Art Unit 233

Stellar: dh

Area Code 703
557-2801

12-5-72

U.S. DEPARTMENT OF COMMERCE
Patent Office

Address Only COMMISSIONER OF PATENTS
Washington, D.C. 20231

Paper No. 8

[Stoller 233
02/22/71 117,285]
Tomas Hirschfeld, et al.

Schiller and Pandiscio
Bear Hill Tower
60 Hickory Dr.
Waltham, Mass. 02154

Mailed "MAILED"
MAY 21 1973
GROUP 231

This is a communication from the Examiner in charge of your application.
Commissioner of Patents

☐ This application has been examined.

☑ Responsive to communication filed 2/22/71 & 2/27/1973 ☑ This action is made final.

A SHORTENED STATUTORY PERIOD FOR RESPONSE TO THIS ACTION IS SET TO EXPIRE 3 MONTH(S) 0 DAYS FROM THE DATE OF THIS LETTER.

PART I

The following attachment(s) are part of this action.

a. ☐ Notice of References Cited, Form PO-892. b. ☐ Notice of Informal Patent Drawing, PO-948

c. ☐ Notice of Informal Patent Application, Form PO-152. d. ☐

PART II

Summary of Action

1. ☑ Claims 1-14 are presented for examination.

2. ☐ Claims _____ are allowed.

3. ☐ Claims _____ would be allowable if amended as indicated.

4. ☑ Claims 1-14 are rejected.

5. ☐ Claims _____ are objected to.

6. ☐ Claims _____ are subject to restriction or election requirement.

7. ☐ Claims _____ are withdrawn from consideration.

8. ☐ Since this application appears to be in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under Ex parte Quayle, 1935 C.D. 11, 453 O.G. 213.

9. ☐ Since it appears that a discussion with applicant's representative may result in agreements whereby the application may be placed in condition for allowance, the examiner will telephone the representative within about 2 weeks from the date of this letter.

10. ☐ Receipt is acknowledged of papers under 35 USC 119, which papers have been placed of record in the file.

11. ☐ Applicant's claim for priority based on an application filed in _____ on _____ is acknowledged. It is noted, however, that a certified copy as required by 35 USC 119 has not been received.

12. ☐ Other

U.S. DEPARTMENT OF COMMERCE
PATENT OFFICE

NOTICE OF REFERENCES CITED

SERIAL NO.	GROUP ART UNIT	ATTACHMENT TO PAPER NUMBER	
117,225	253		6

APPLICANT(S)
T. HILSCHIFELD ET. AL.

U.S. PATENTS

*		PATENT NO.	DATE	PATENTEE	CLASS	SUB-CLASS	FILING DATE IF APPROPRIATE
	A	[illegible]	5/2/71	K. WECU	106	F.2	2/16/69
	B	[illegible]	8/16/72	E. FRISCHLE	106	F.2	11/21/69
	C	[illegible]	6/6/69	J.J. STONE	345	19	
	D						
	E						
	F						
	G						
	H						
	I						
	J						
	K						

FOREIGN PATENTS OR PUBLISHED APPLICATIONS

*		PATENT NO.	DATE	COUNTRY	NAME	CLASS	SUB-CLASS	PERTINENT SHEET AND LINE
	L							
	M							
	N							
	O							
	P							
	Q							

OTHER REFERENCES (Including Author, Title, Date, Pertinent Pages, Etc.)

R	
S	
T	
U	

EXAMINER
GEO. STELLAR

DATE
12/4/72

☐ CHECK HERE IF FOREIGN EXCHANGE

The specification is again objected to under 35 USC 112, with respect to the subject matter recited in claims 11, 12 and 13. The statement "While the Office will not require applicants to disclose the particular details of the "logic circuit", the Office will not allow claims to the subject matter concerned" which applicants found confusing and controdictory might be restated: while the Office cannot require (i.e., is powerless under the law) applicants to disclose the particular details of the "logic circuit", the Office will not allow claims to the subject matter concerned. Applicant's statement that "the particular 'logic circuit' employed constitutes a device or system well known in the art" is unsupported by any evidence. It is contended that the selection or design of the required subsystem is neither well within the skill of one of ordinary skill in the art, nor could the details be determined routinely with little or no experimentation. Further it is contended that the last phase of 35 USC 112 paragraph 1, "*and* shall set forth the best mode contemplated by the inventor of carrying out his invention" (emphasis added) was intended to deny Patent Rights to situations such as the one at hand.

Claims 1 through 14 are again rejected under 35 USC 112. With respect to claim 1: "an image formed on an image surface in said device" is functional—a statement of a desired situation without statements or required structure: the claim is incomplete without first a "means for providing a plurality of pairs of digital signals, each corresponding to a pair of coordinates of a corresponding predetermined point on said image surface"; the claim is incomplete without apparatus to produce "selected pairs"; line 14 should read "means for applying at least one of said . . ." if the claim is to describe one dimensional deflection, otherwise "lateral" must be defined as two dimensional. Claim 6 is incomplete because it is not sufficiently

related to the preceding structure. In claim 11, "and being capable of integrating the radiation falling on each point thereof" is functional; the remainder of the claim is not clearly understood. Claim 12 is functional. Claim 13 is not clearly understood and appears to be incomplete. The reasoning behind applicants arguments is not considered to conform to the contemporary standards for defining incompleteness and functionality.

Claims 1, 2, 4 and 14 are again rejected under 35 USC 102 as anticipated by Nezu as the signals on lines 124 of Figure 2 are certainly "analog-valued steady state control signals".

Should applicant's attempt to redefine "control signals", a new rejection based at least in part on the cited Froschle patent might be necessitated.

Claims 3 and 5 through 10 are rejected under 35 USC 103 as unpatentable over Nezu. The claimed subject matter is deemed obvious to one of ordinary skill in the art in view of Nezu and the working knowledge of the art carried by one of ordinary skill in the art for the following reasons treated briefly. With respect to claim 3, storage of digital signals is well known; storage is employed when one wishes to be able to reproduce information at a subsequent time. With respect to claim 5, all commercial cameras include "means for selectively activating" e.g. by way of a master ON-OFF switch or power jack. With respect to claim 6, "sequentially selecting" is the expected functioning of Nezu. With respect to claim 7, such structure is expected to be found in the computer of Nezu. With respect to claim 8, the computer of Nezu is expected to have a memory; it would be obvious to employ some for output signals because it is at hand. With respect to claims 9 and

10 see Nezu at column 4 lines 36–38. Applicant's remarks have been considered but are not found persuasive.

This action is made FINAL.

/s/ _____

ROBERT L. GRIFFIN
Examiner
Group Art Unit 233

Stellar:dh
Area Code 703
557-2801
04-26-73

Stellar 233
02-22-71 117 285
TOMAS HIRSCHFELD, ET AL
Paper No. 11

Mailed June 12, 1973

Group 233

Schiller and Pandiscio
Bear Hill Tower, 60 Hickory Dr.
Waltham, Mass. 02154

Please find below a communication from the EXAMINER in charge of this application.

Commissioner of Patents

Applicants' amendment of May 18, 1973 has been entered. Applicants are advised to respond to the rejection of May 21, 1973 by treating the rejections of claims 11, 12 and 13 as applying to claims 15, 12 and 13 respectively. The shortened statutory period for response to the rejection of May 21, 1973 is hereby reset to expire Three Months from the date of this letter.

/s/ _____
HOWARD W. BRITTON
Examiner
Group Art Unit 233

Stellar:iw
Area Code 703
557-2801
06-07-73

APPENDIX E

APPLICATION

FOR

UNITED STATES LETTERS PATENT

February 22, 1971

SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

Be it known that TOMAS HIRSCHFELD and MARVIN MARGOSHES, respectively, of Farmingham, Massachusetts, and Chevy Chase, Maryland have invented certain improvements in DIGITALLY CONTROLLED ELECTRO-OPTICAL IMAGING SYSTEM of which the following description in connection with the accompanying drawings is a specification, like reference characters on the drawings indicating like parts in the several figures.

In the United States Patent Office

ABSTRACT OF THE DISCLOSURE:

An electronic image-encoder with an SEC vidicon in which the electron beam is positioned according to a coordinate pair stored as digital signals and applied as analog signals to the deflection coils of the vidicon. This permits the beam to read selected points in the vidicon target and the beam is blanked until the desired deflection signals are applied.

In one version of the device, the deflection signals are simply voltages corresponding to the values of the digital signals. In another version, one digital signal is converted

to an analog deflection voltage and a standard ramp is used as the other deflection voltage, the beam being turned on to read only after a time interval following initiation of the ramp, which interval is proportional to the other digital signal.

A special application of the encoder incorporates a crossed-dispersion optical system for projecting several stacked spectral orders into the vidicon target.

In all cases, the electron beam actuation provides an output signal corresponding to the image intensity at the point selected by the digital signal pair, and this output signal is digitized for storage, manipulation or display.

The present invention relates to image-dissection systems and more particularly to an electronic image dissection system employing a television camera tube as an image pickup device.

A number of electronic camera tubes or photosensitive devices are known and usually function on the basis of scanning an electron beam in a repetitive pattern across successive elements of the image formed in the tube. Such scanning results in the image elements being transmitted in an orderly sequence which is then repeated. The scan can, of course, be horizontal, vertical or even spiral. To effect this scanning of the electron beam, repetitive waveforms such as saw-tooth currents, are applied to horizontal and vertical deflection plates or coils adjacent to the electron source or gun.

A relatively new type of light detector useful as a camera tube is the secondary electron conduction (SEC) vidicon. In this detector, electrons from the photocathode are highly accelerated and focused onto a nonconducting target, made of fibrous potassium chloride. The signals are amplified at the target at a secondary electron avalanche process. The electrons drain off through a conductive elec-

tron plate leaving a positive charge at each point on the target proportional to the number of photons arriving at the equivalent point on the photocathode during the exposure period. This charge is trapped in the potassium chloride crystal lattice and it remains stable until readout (up to several hours). The tube can be used to integrate signals for long periods if necessary. Each resolution element thus acts as a detector, amplifier, and integrator.

Readout of the vidicon and other tubes such as the image orthicon is usually accomplished by scanning the target with an electron beam. If, however, one wishes to examine one point or element of the target, it has heretofore been necessary to go through the scan path or raster from its beginning until the beam arrives at the location of the target element in question. This, of course, introduces delay into the process of obtaining the information. If the image on the target or screen is presented as a row of columns or lines and one wishes to examine some location in a particular column, a standard scan will tend to examine not only the columns but the intercolumnar areas in which no image occurs, and the standard scanning systems are also, in this context, wasteful of time.

Also, the dynamic range of integrating imaging devices such as the image orthicon and SEC vidicon is limited to usually around 100:1 at best. Assertions of a dynamic range of 300:1 for an MgO target have been made, but not for low light levels.

The present invention has as a principal object the extension of the dynamic range of integrating imaging devices.

The present invention is also particularly intended to obviate the foregoing delay problem by providing access to predetermined locations on a target with minimized delay. Another principal object of the present invention is

therefore to provide a system for controlling electron-beam readout of an electronic camera tube without resort to a repetitive two-dimensional scan. Yet other objects of the present invention are to provide a camera tube control system of the type described in which the control is digital; to provide such a digitally controlled system wherein the operation of the electron beam is accomplished by a digital computer; and to provide a system for detecting and measuring electromagnetic spectra with an electronic camera tube system; i.e., to provide a spectrometer using a television-type detector as the photosensitive pickup.

To effect these and other objects of the invention, generally readout of the target in a tube is done in a rapid stepwise fashion under control of the computer. When the beam is directed at a point on the target, there is a current pulse proportional to the positive charge at that point. Once the charge is neutralized, no further current flows. The current pulse is, therefore, the output signal from the system indicating the image intensity at the selected point on the target and can be digitized and stored in the computer. The electron beam is directed to the selected point by digital X and Y address signals provided by the computer and converted to steady state control voltages which position the beam. In an alternative embodiment, the camera target is scanned by the beam digitally in one direction and with a continuous sweep in the orthogonal direction, the beam being triggered as it passes over the line or column of interest. In both cases, the system also preferably includes means for providing a full overscan raster pattern of the standard type for clearing the target.

To increase the dynamic range of the device, generally the electron beam is directed to read selected areas of the target which are expected to be at high illumination levels while not reading weakly illuminated areas. This permits

integration buildup of the signal on the latter areas. Thus, high intensity areas are read out at once while low intensity areas are read out only when the signal has built up sufficiently to yield a relatively high signal-to-noise ratio. The "observed" contrast is thus increased by a factor equal to the number of scans used.

Other objects of the present invention will, in part, appear obvious and will, in part, appear hereinafter. The invention accordingly comprises the apparatus possessing the construction, combination of elements and arrangement of parts which are exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the claims.

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